



Rapport de veille n° 86

BIM

30/09/2026

Objectif : *L'utilisation du BIM en phase de conception et de ses potentiels applications pour la prévention des risques*

La validation des informations fournies (exactitude, fiabilité, pertinence par rapport aux principes de prévention, etc.) est du ressort des auteurs des articles signalés dans la veille. Les informations ne sont pas le reflet de la position de l'INRS.

Les liens mentionnés dans le bulletin donnent accès aux documents sous réserve d'un abonnement à la ressource.

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1. Articles scientifiques

AI-BIM Integration in Construction Management: Advancing Workplace Safety, Hazard Identification, and Risk Mitigation

MA Khan, MS Ahsraf, M Jahanzeb, MSU Khan... - International Journal of Artificial Intelligence and Machine Learning, 6(9s), 1287–1303

DOI : <https://doi.org/10.51483/IJAIML.6.9s.2026.1287-1303>

Construction remains one of the world's most hazardous industries, accounting for disproportionately high rates of occupational injuries and fatalities. Building Information Modeling (BIM) has emerged as a transformative technology with significant potential to revolutionize safety management across the construction project lifecycle. This literature review synthesizes current evidence on BIM-integrated safety management approaches, examining hazard identification, visualization, real-time monitoring, and proactive risk mitigation. Through systematic analysis of 125+ peer-reviewed studies, the review demonstrates that BIM, when integrated with emerging technologies such as the Internet of Things (IoT), artificial intelligence (AI), and virtual reality (VR), enables substantial reductions in construction workplace accidents. The findings reveal that BIM integration can reduce accident rates by 38-42%, enhance early hazard detection by 95%, and improve safety communication through collaborative visualization. However, widespread adoption faces barriers including high implementation costs, interoperability challenges, and workforce skill gaps. This review identifies critical research gaps regarding BIM-driven safety culture development, real-time safety monitoring standardization, and post-construction maintenance integration. Future research directions emphasize longitudinal studies on sustained safety outcomes, development of standardized data formats for seamless interoperability, and exploration of AI-augmented safety systems. The integration of BIM into construction safety protocols presents unprecedented opportunities for transitioning from reactive to proactive safety management, creating safer, more efficient, and more productive construction environments.

The BIM-based investment risk management framework in construction projects

M Szóstak, U Kwast-Kotlarek - Civil and Architectural Engineering, 25(3), p. 26047

DOI : [10.35784/bud-arch.9314](https://doi.org/10.35784/bud-arch.9314)

The article addresses risk management in building construction projects amid increasing technical, organisational, and informational complexity. It presents an approach in which the Building Information Modelling (BIM) environment serves as an active risk management tool, integrating risk identification, analysis, and monitoring with project information management in accordance with ISO 19650. The study highlights the role of key project documents - Employer's Information Requirements (EIR) and the BIM Execution Plan (BEP) - in mitigating organisational and technical risks. It also examines contractual risks in public procurement, the legal status of BIM models versus traditional documentation, and issues of intellectual property and data access within the Common Data Environment (CDE). The article proposes using the RACI matrix for systematic allocation of risk management responsibilities among stakeholders. Integration of BIM coordination, clash detection, data interoperability analyses, and BIM for Safety enables early identification of technical risks. The study's main contribution is an integrated, application-oriented risk management model combining EIR and BEP, the RACI matrix, and BIM for Safety principles, serving as a reference for contractual and risk management procedures. Results show that BIM transforms risk management from reactive to proactive, data-driven, and continuous, shifting BIM from a design-support tool to an integrated environment covering the entire building life cycle.

Mapping two decades of construction OSH research in Malaysia: bibliometric evidence of thematic evolution and knowledge fragmentation

CKI Che Ibrahim, RA Rahman, NH Abas, JBH Yap - Journal of Engineering, Design and Technology, 2026
DOI : <https://doi.org/10.1108/JEDT-05-2026-0325>

Although Malaysian construction occupational safety and health (OSH) research has expanded significantly across multiple domains, the knowledge base remains fragmented, with limited understanding of its intellectual evolution, thematic convergence and alignment with national regulatory and industry transformation agendas. This study aims to systematically map the intellectual evolution, thematic structure and future direction of construction OSH research in Malaysia. A bibliometric review of 224 Scopus-indexed publications between 2006 and March 2026 was conducted. Performance analysis examined publication growth, citation impact, sources, authors, institutions and country contributions, while science mapping and thematic analysis were used to interpret keyword structures and emerging clusters. Malaysian construction OSH research expanded substantially after 2020, shifting from reactive accident reporting and site-level safety management towards proactive concerns with governance, digital safety, upstream design responsibility, worker vulnerability and safety culture and duty-holder accountability. Six themes were identified: industry-level health and safety governance; accident prevention and technology-enabled risk evidence; project actors and duty-holder roles; upstream prevention, performance and worker vulnerability; BIM-enabled safety management and adoption barriers and behavioural compliance and safety participation. Although increasingly aligned with Malaysia's CDM Regulations 2024, the field remains fragmented across accident, technology, governance, design and behavioural research streams.

Technologies for accident prevention in forklift operations and safety in human-machine interaction: a scoping review

BP Bastos, GM Silva, G Agnolin, ARP Moro - Revista Brasileira de Saúde Ocupacional, 51, 2026
DOI : <https://doi.org/10.1590/2317-6369/12425en2026v51e27>

Accidents involving machinery and forklifts are a major cause of worker fatalities. The Fourth Industrial Revolution and Health 4.0, with technologies such as wearables and the Internet of Things, offer solutions to prevent accidents. To map scientific evidence on the implementation of collision-prevention technologies in forklift operations, with a focus on reducing accidents and promoting a safe work environment. A scoping review was conducted with searches of 11 databases. The research protocol was registered on the Open Science Framework (OSF) (). Articles available in full text, in any language, and without time restrictions were included. The initial search yielded 390 articles, of which eight were selected for this review. The main approaches analyzed included the Industrial Internet of Things, computer vision, automation, 3D image capture, and data analysis.

2. Conférence / ouvrage / thèse

Integrating RAG-LLMs with BIM for Automated Fall Hazard Detection and Prevention in Building Design

M Hussain, T Tan, Z Zhang, M Yalan - Conference: 43rd International Symposium on Automation and Robotics in ConstructionAt: SingaporeVolume: 43, June 2026

DOI : 10.22260/ISARC2026/0182

Falls from height (FFH) remain a leading cause of construction injuries and fatalities, necessitating proactive Design-for-Safety (DfS) approaches. While Building Information Modeling (BIM) facilitates safety checks, existing Automated Rule Checking (ARC) models rely on rigid, manual rule-coding and lack the spatial reasoning required to interpret complex safety regulations. This paper proposes a Retrieval-Augmented Generation (RAG) Large Language Model (LLM) pipeline integrated with BIM for automated FFH identification and prevention. The methodology incorporates a domainspecific ontology that maps unstructured regulatory constraints to BIM geometry, enabling the precise detection of spatial hazards. Additionally, the system automates the placement of preventive measures, such as Occupational Safety and Health Administration (OSHA)-compliant guardrails, directly within the design model. By bridging the gap between semantic regulatory interpretation and geometric analysis, this approach overcomes the spatial limitations of current LLM-BIM frameworks, empowering designers to eliminate fall hazards early in the project design.

BIM utilisation for health and safety management in the Ghanaian construction industry

H Pittri, GAGR Godawatte, E Narh, K Agyekum - Proceedings of the Institution of Civil Engineers - Smart Infrastructure and Construction 1–13.

DOI : <https://doi.org/10.1680/jsmic.24.00031>

Building information modelling (BIM) offers considerable potential to improve safety outcomes across the project lifecycle; however, its uptake in developing countries, including Ghana, continues to face significant challenges. This study explores the application of BIM for health and safety (H&S) management in the construction industry of Ghana. Adopting a quantitative method for the study, a structured questionnaire was used to collect data from 208 construction professionals in Ghana using the convenience and snowball sampling techniques. The collected data were analysed using frequencies, mean scores, and analysis of variance (ANOVA). The findings indicate low overall utilisation of BIM for H&S management among the professionals. ANOVA results revealed significant differences based on profession and company size, with medium-sized firms and civil/structural engineers showing higher engagement. No significant variation was found across employment categories. These results highlight the need for targeted training and support, particularly for underrepresented professions. This study addresses a relatively underexplored area in the construction sector, particularly within the context of a developing country like Ghana. By offering empirical evidence and practical insights, it contributes to a broader understanding of how innovative technologies can be harnessed to enhance H&S management in emerging economies.

Exploring barriers and pathways to digital health and safety management in UK construction: a qualitative study

EI Daniel, CA Adah, O Oshodi, ID Daniel - In: Chow, Vand Neilson, C J (Eds) Proceedings of the 42nd Annual ARCOM Conference, 7-9 September 2026, Loughborough University, UK, Association of Researchers in Construction Management, 324-333

The construction industry remains one of the most hazardous sectors globally, driving interest in digital technologies to improve health and safety management (HSM). Although previous research highlights the

potential of technologies such as artificial intelligence, building information modelling, and wearable devices, limited empirical evidence has examined implementation barriers from practitioners' perspectives. This study addresses that gap through qualitative research based on semi-structured interviews with 20 construction professionals across England, Scotland, Wales, and Northern Ireland, analysed using thematic analysis. Findings identify five key barriers to digital HSM adoption: data privacy and security concerns, resistance to change, high implementation costs, limited human oversight, and reliability issues. The study also identifies four strategies to improve implementation: demonstrating clear benefits and practical applications, involving workers in adoption, strengthening training and education, and enhancing policy and governance support. The paper argues that digitalising HSM in UK construction is a socio-technical challenge shaped by trust, organisational culture, cost, and regulatory assurance rather than a purely technical issue. It provides practitioner-based insights to support wider adoption of digital technologies in construction health and safety management.